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CHAPTER 1

Victor 9000 System Overview

1.1 Computer

The Victor 9000 computer is based upon the Intel 8088 16-bit microprocessor. This processor chip is directly related to the Intel 8086 16-bit microprocessor, but with two subtle differences:

8088	8086
8-bit data bus	16-bit data bus
4 instruction look-ahead	6 instruction look-ahead

The major difference, the 8-bit data bus, has some effect on the relative abilities of the two chips; the main difference is that while the 8086 can load an entire 16-bit word of data directly, the 8088 has to load two 8-bit bytes to achieve the same result - the outcome of which being that the 8088 processor is a little slower than the 8086. The loss of speed, however, is balanced by the fact that the cost of the main circuit board and add-on boards are lower than for the wider 8086 requirement. This means that the end-user will have the best cost/performance ratio for a 16-bit computer.

1.2 Memory

The Victor 9000 has a maximum memory capacity of 896 kilobytes of Random Access Memory or "RAM" (a measure of a computer's internal storage capacity; a "kilobyte" is 1,024 bytes). A byte is able to store one character of data - thus the Victor 9000, with full 896k memory capacity is able to hold, internally, nearly 1 million characters - compare this figure with the older Z80 or 6502 computers that have a maximum memory capacity of less than 70,000 characters or 64k bytes of RAM.

1.3 Disk System

The Victor 9000 has several integral disk configurations available; these are:

- o Twin single-sided 600k bytes per drive 5 1/4-inch minifloppies, giving a total capacity of 1.2Mbytes (1,200kbytes) available on-line.
- o Twin double-sided 1.2M bytes per drive 5 1/4-inch minifloppies, giving a total capacity of 2.4Mbytes (2,400kbytes) available on-line.
- o Single 10M byte hard disk (Winchester) plus a single double-sided 1.2M byte 5 1/4-inch minifloppy, giving a total capacity of 11.2Mbytes (11,200kbytes) available on-line.

Future disk systems will include an external 10Mbyte hard disk (Winchester) that will allow expansion of any of the above systems by a further 10,000k bytes.

Although the Victor 9000 uses 5 1/4-inch minifloppies of a similar type to those used in other computers, the floppy disks themselves are not readable on other machines, nor can the Victor 9000 read a disk from another manufacturers machine. The Victor 9000 uses a unique recording method to allow the data to be packed as densely as 600kbytes on a single-sided single-density minifloppy; this recording method involves the regulation of the speed at which the floppy rotates, explaining the fact that the noise from the drive sometimes changes frequency.

1.4 Display System

The display unit swivels and tilts to permit optimum adjustment of the viewing angle, and the unit incorporates a 12-inch antiglare screen to prevent eye strain. The display, in normal mode, is 25 lines, each line having 80 columns. Characters are formed, in normal mode, in a 10-x-16 font cell, providing a highly-readable display. The screen may be used in high-resolution mode, providing a bit-mapped screen with 800-x-400 dot matrix resolution. The high-resolution mode is available only under software control, there is no means of simply "switching" in to high-resolution. Victor Technologies has provided software to allow full use of the screen in high-resolution mode in the Graphics Tool Kit.

Character sets are "soft" - that is they may be substituted for alternative character sets of the users choice, or creation. Only one 256-character character set may be displayed on the screen at one time - multiple character sets cannot, currently, be displayed simultaneously - but this feature may well become available in the future. Character set manipulation software is available in both the Graphics and Programmers Tool Kits.

1.5 Keyboard

Several different types of keyboards are offered. Each keyboard is a separate, low-profile module with an optional palm rest for ease of use. Every key is programmable, permitting the offering of a National keyboard in each country in which it is marketed. As a result, the keyboard can be customized to satisfy the requirements of foreign languages and so that striking a key enters a character or predetermined set of commands.

Keyboards are as soft as the character sets - this allows a keyboard to be generated to match a newly created or special character set. Each key on the keyboard has three potential states; the unshifted, shifted and alternate. The unshifted mode is accessed when the shift key is not depressed along with the desired key; the shifted mode is accessed when the shift key is depressed along with the desired key; and the alternate mode is accessed when the ALT key is depressed along with the desired key. Keyboard manipulation software is available in both the Graphics and Programmers Tool Kits.

1.6 Memory Map

The Victor 9000 is currently supplied with two major disk operating systems; CP/M-86 from Digital Research, and MS-DOS from Microsoft. Although these two operating systems appear superficially similar, they are quite different in their operation, program interfacing techniques, and their memory structure. The following diagrams are the memory maps for CP/M-86 and MS-DOS; you will notice that some aspects of the machine never change, such as the screen RAM and interrupt vector locations, these areas are hardware defined, and as such never alter. The memory maps for MS-DOS and CP/M-86 are not fixed in the Victor 9000, thus some of the elements of the map will not be specific; this is not to be deliberately vague, but improvements to the performance aspects of the software do take place forcing the diagrams to be unspecific to some degree.

Supplemental Technical Reference Material

1.6.1 Memory Map -- MS-DOS Operating System

FFFFF	
FC000	Boot Proms
F4000	Reserved for Future Expansion
F0000	Screen High-Speed Static RAM
	Memory-Mapped I/O Space
E0000	

etc.	
256k=3FFF0	BIOS
128k=1FFF0	Operating System -----
	MS-DOS
	Command - Resident Portion
	Command - Transient Portion

Transient Program Area (TPA)

	<u>Alternate Character Set</u>	4k bytes
	<u>128 Character Set</u>	4k bytes
00480	Logo	2k bytes
00400	"Stub" - Jump Vectors	128 bytes
00000	Interrupt Vector Table	1k bytes

Supplemental Technical Reference Material

1.6.2 Memory Map -- CP/M-86 Operating System

FFFFF	Boot Proms
FC000	Reserved for Future Expansion
F4000	Screen High-Speed Static RAM
F0000	Memory-Mapped I/O Space
E0000	
	BIOS
	Operating System -----
	BDOS

Transient Program Area (TPA)

	Alternate Character Set	4k bytes
	128 Character Set	4k bytes
	Logo	2k bytes
00480	"Stub" - Jump Vectors	128 bytes
00400	Interrupt Vector Table	1k bytes
00000		

CHAPTER 2

Display Driver Specifications

2.1 Overview

The display system in the Victor 9000 is, like so much of the machine, soft. The operating system BIOS contains the Zenith H-19 video terminal emulator, which is an enhanced control set of the DEC VT52 crt. The BIOS takes all ASCII characters received and either displays them or uses their control characteristics. The control characters 00hex (00decimal) thru 1Fhex (31decimal) and 7Fhex (127decimal) are not displayed under normal circumstances. The non-display characters previously discussed, plus those characters having the high-bit set, being 80hex (128decimal) through FFhex (255decimal), may be displayed on the screen under program control, but extensive use of these characters is easier with the Victor Technologies character graphics utilities.

Most of the control characters act by themselves; for example, the TAB key (Control I, 09hex, 09decimal) will cause the cursor to move to the right to the next tab position. For more complex cursor/screen control the multiple character escape sequences should be used. The control characters, and the escape sequences are fully described below.

2.2 Screen Control Sequences

Single Control Characters

Bell (Control G, 07hex, 07decimal - ASCII BEL)

This ASCII character is not truly a displaying character, but causes the loudspeaker to make a beep.

Backspace (Control H, 08hex, 08decimal - ASCII BS)

Causes the cursor to be positioned one column to the left of its current position. If at column 1, it causes the cursor to be placed at column 80 of the previous line; if the cursor is at column 1, line 1, then the cursor moves to column 80 of line 1.

Horizontal Tab (Control I, 09hex, 09decimal - ASCII HT)

Positions the cursor at the next tab stop to the right. Tab stops are fixed, and are at columns 9, 17, 25, 33, 41, 49, 57, 65, and 72 through 80. If the cursor is at column 80, it remains there.

Line Feed (Control J, 0Ahex, 10decimal - ASCII LF)

Positions the cursor down one line. If at line 24, then the display scrolls up one line. This key may be treated as a carriage return -- see ESC x9.

Carriage Return (Control M, 0Dhex, 13decimal - ASCII CR)

Positions the cursor at column 1 of the current line. This key may be treated as a line feed -- see ESC x8.

Shift Out (Control N, 0Ehex, 14decimal - ASCII SO)

Shift out of the standard system character set, and shift into the alternative system character set (Character set 1, G1). This gives the ability to access and display those characters having the high-bit set - being those characters from 80hex (128decimal) through FFhex (255decimal).

Shift In (Control O, 0Fhex, 15decimal - ASCII SI)

Shift into the standard system character set (Character set 0, G0). This gives the ability to access and display the standard ASCII character set - being those characters from 00hex (00decimal) through 7Fhex (127decimal).

2.3 Multi-Character Escape Sequences

2.3.1 Cursor Functions

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>
ESC A	1B, 41hex 27, 65dec	Move cursor up one line without changing column.
ESC B	1B, 42hex 27, 66dec	Move cursor down one line without changing column.
ESC C	1B, 43hex 27, 67dec	Move cursor forward one character position.
ESC D	1B, 44hex 27, 68dec	Move cursor backward one character position.
ESC H	1B, 48hex 27, 72dec	Move cursor to the home position. Cursor moves to line 1, column 1.
ESC I	1B, 49hex 27, 73dec	Reverse index. Move cursor up to previous line at current column position.
ESC Y 1 c	1B, 59hex 27, 89dec	Moves the cursor via direct (absolute) addressing to the line and column location described by '1' and 'c'. The line ('1') and column ('c') coordinates are binary values offset from 20hex (32decimal). (For further information on the use of direct addressing see section 2.4).
ESC j	1B, 6Ahex 27, 106dec	Store the current cursor position. The cursor location is saved for later restoration (see ESC k).
ESC k	1B, 6Bhex 27, 107dec	Returns cursor to the previously saved location (see ESC j).
ESC n	1B, 6Ehex 27, 110dec	Return the current cursor position. The current cursor location is returned as line and column, offset from 20hex (32decimal), in the next character input request.

2.3.2 Editing Functions

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>
ESC @	1B, 40hex 27, 64dec	Enter the character insert mode. Characters may be added at the current cursor position, as each new character is added, the character at the end of the line is lost.
ESC E	1B, 45hex 27, 69dec	Erase the entire screen.
ESC J	1B, 4Ahex 27, 74dec	Erase from the current cursor position to the end of the screen.
ESC K	1B, 4Bhex 27, 75dec	Erase the screen from the current cursor position to the end of the line.
ESC L	1B, 4Chex 27, 76dec	Insert a blank line on the current cursor line. The current line, and all following lines are moved down one, and the cursor is placed at the beginning of the blank line.
ESC M	1B, 4Dhex 27, 77dec	Delete the line containing the cursor, place the cursor at the start of the line, and move all following lines up one - a blank line is inserted at line 24.
ESC N	1B, 4Ehex 27, 78dec	Delete the character at the cursor position, and move all other characters on the line after the cursor to the left one character position.
ESC O	1B, 4Fhex 27, 79dec	Exit from the character insert mode (see ESC @).
ESC b	1B, 62hex 27, 98dec	Erase the screen from the start of the screen up to, and including, the current cursor position.

Supplemental Technical Reference Material

2.3.2 Editing Functions -- continued

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>
ESC 1	1B, 6Chex 27, 108dec	Erase entire current cursor line.
ESC o	1B, 6Fhex 27, 111dec	Erase the beginning of the line up to, and including, the current cursor position.

2.3.3 Configuration Functions

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>																				
ESC x Ps	1B, 78hex 27, 120dec	Sets mode(s) as follows: <table> <thead> <tr> <th>Ps</th><th>Mode</th></tr> </thead> <tbody> <tr> <td>31hex, 49dec</td><td>1 Enable 25th line</td></tr> <tr> <td>33hex, 51dec</td><td>3 Hold screen mode on</td></tr> <tr> <td>34hex, 52dec</td><td>4 Block cursor</td></tr> <tr> <td>35hex, 53dec</td><td>5 Cursor off</td></tr> <tr> <td>38hex, 56dec</td><td>8 Auto line feed on receipt of a carriage return.</td></tr> <tr> <td>39hex, 57dec</td><td>9 Auto carriage return on receipt of line feed</td></tr> <tr> <td>41hex, 65dec</td><td>A Increase audio volume</td></tr> <tr> <td>42hex, 66dec</td><td>B Increase CRT brightness</td></tr> <tr> <td>43hex, 67dec</td><td>C Increase CRT contrast</td></tr> </tbody> </table>	Ps	Mode	31hex, 49dec	1 Enable 25th line	33hex, 51dec	3 Hold screen mode on	34hex, 52dec	4 Block cursor	35hex, 53dec	5 Cursor off	38hex, 56dec	8 Auto line feed on receipt of a carriage return.	39hex, 57dec	9 Auto carriage return on receipt of line feed	41hex, 65dec	A Increase audio volume	42hex, 66dec	B Increase CRT brightness	43hex, 67dec	C Increase CRT contrast
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42hex, 66dec	B Decrease CRT brightness																					
43hex, 67dec	C Decrease CRT contrast																					
ESC [1B, 5Bhex 27, 91dec	Set hold mode																				
ESC \	1B, 5Chex 27, 92dec	Clear hold mode																				
ESC ^	1B, 5Ehex 27, 94dec	Toggle hold mode on/off.																				

2.3.4 Operation Mode Functions

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>
ESC (1B, 28hex 27, 40dec	Enter high intensity mode. All characters displayed after this point will be displayed in high-intensity.
ESC)	1B, 29hex 27, 41dec	Exit high intensity mode.
ESC @	1B, 30hex 27, 48dec	Enter underline mode. All characters displayed after this point will be underlined.
ESC 1	1B, 31hex 27, 49dec	Exit underline mode.
ESC p	1B, 70hex 27, 112dec	Enter reverse video mode. All characters displayed after this point will be displayed in reverse video.
ESC q	1B, 71hex 27, 113dec	Exit reverse video mode.

2.3.5 Special Functions

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>
ESC #	1B, 23hex 27, 35dec	Return the current contents of the page. The entire contents of the screen are made available at the next character input request(s). (For further information on the use of this function, see section 2.5).
ESC \$	1B, 24hex 27, 36dec	Return the value of the character at the current cursor position. The character is returned in the next character input request.
ESC +	1B, 2Bhex 27, 43dec	Clear the foreground. Clear all high-intensity displayed characters.
ESC 2	1B, 32hex 27, 50dec	Make cursor blink.
ESC 3	1B, 33hex 27, 51dec	Stop cursor blink.
ESC 8	1B, 38hex 27, 56dec	Set the text (literally) mode for the next single character. This allows the display of characters from 01hex (01dec) thru 1Fhex (31dec) on the screen. Thus the BELL character (07hex, 07dec) will not cause the bleep, but a character will appear on the screen.
ESC Z	1B, 5Ahex 27, 90dec	Identify terminal type. The VT52 emulator will return ESC\Z in the next character input request.
ESC]	1B, 5Dhex 27, 93dec	Return the value of the 25th line. The next series of character input requests will receive the current contents of the 25th line.

Supplemental Technical Reference Material

2.3.5 Special Functions -- continued

<u>Escape Sequence/Function</u>	<u>ASCII Code</u>	<u>Performed Function</u>										
ESC v	1B, 76hex 27, 118dec	Enable wrap-around at the end of each screen line. A character placed after column 80 of a line will be placed on the next line at column 1.										
ESC w	1B, 77hex 27, 119dec	Disable wrap-around at the end of each line.										
ESC z	1B, 7Ahex 27, 122dec	Reset terminal emulator to the power-on state. This clears all user selected modes, clears the screen, and homes the cursor.										
ESC {	1B, 7Bhex 27, 123dec	Enable keyboard input. (see ESC }).										
ESC }	1B, 7Dhex 27, 125dec	Disable keyboard input. This locks the keyboard. Any character(s) typed are ignored until an ESC { is issued.										
ESC i Ps	1B, 69hex 27, 105dec 30hex, 48dec 31hex, 49dec 32hex, 50dec 33hex, 51dec	Displays banner as follows: <table border="1"> <thead> <tr> <th>Ps</th> <th>Mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Display entire banner</td> </tr> <tr> <td>1</td> <td>Display company logo</td> </tr> <tr> <td>2</td> <td>Display operating system</td> </tr> <tr> <td>3</td> <td>Display configuration</td> </tr> </tbody> </table>	Ps	Mode	0	Display entire banner	1	Display company logo	2	Display operating system	3	Display configuration
Ps	Mode											
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3	Display configuration											

2.4 Direct Cursor Addressing -- Examples of Use

The direct cursor addressing function is accessed by sending the ESC Y 1 c sequence to the screen (see section 2.3.1). "1" is the line number required, whose valid coordinates are between 1 and 24. An offset of 1Fhex (31decimal) must be added to the location required in order to correctly locate the cursor. "c" is the column number required, whose valid coordinates are between 1 and 80. An offset of 1Fhex (31decimal) must be added to the location required in order to correctly locate the cursor.

Note that the true offset requirement of 20hex (32decimal) for line and column may only be used accurately when the line number is viewed 0 to 23, and the column number 0 to 79.

The line/column number requested must be handled as a binary digit, examples of this follow:

2.4.1 Microsoft MS-BASIC -- Direct Cursor Positioning

The following method uses offsets from line 1, column 1:

```
10 PRINT CHR$(27)+"E"      :REM CLEAR THE SCREEN
20 DEF FNMS$(LIN,COL)=CHR$(27)+"Y"+CHR$(31+LIN)+CHR$(31+COL)
30 PRINT "Enter line (1-24) and column (1-80), as LINE,COL ";
40 INPUT LIN, COL
50 PRINT FNMS$(LIN,COL);
60 FOR I = 1 TO 1000      :REM PAUSE BEFORE OK MESSAGE DISPLAYED
70 NEXT I
```

The alternative method, using offsets from zero is shown below:

```
10 PRINT CHR$(27)+"E"      :REM CLEAR THE SCREEN
20 DEF FNMS$(LIN,COL)=CHR$(27)+"Y"+CHR$(32+LIN)+CHR$(32+COL)
30 PRINT "Enter line (0-23) and column (0-79), as LINE,COL ";
40 INPUT LIN, COL
50 PRINT FNMS$(LIN,COL);
60 FOR I = 1 TO 1000      :REM PAUSE BEFORE OK MESSAGE DISPLAYED
70 NEXT I
```

2.4.2 Microsoft MACRO-86 Assembler -- Direct Cursor Positioning

```

line_off  equ  20h          ;line position offset from 0
col_off   equ  20h          ;column position offset from 0
esc       equ  1bh          ;escape character
msdos    equ  21h          ;interrupt to MS-DOS

clear_screen      db    esc,'E$' ;clear screen request
dir_cur_pos_lead db    esc,'Y$' ;cursor positioning lead-in

; the cursor position required is handed down in BX
;   where BH = line (0-23 binary), BL = column (0-79 binary)

clear_and_locate:
    mov  ah,9h          ;string output up to $
    mov  dx,offset clear_screen ;get the clear screen string
    int  msdos          ;and output it up to the $

; the cursor position required is in BX
;
    add  bh,line_off    ;normalize line for output
    add  bl,col_off     ;normalize column for output
;
; send the direct cursor positioning lead-in
;
    mov  ah,9h          ;select screen output up to $
    mov  dx,offset dir_cur_pos_lead ;select the lead in ESC Y
    int  msdos          ;and output it up to $

; now the contents of BX must be sent to the terminal emulator
;
    mov  dl,bh          ;ready the line number
    mov  ah,6h          ;direct console output of DL
    int  msdos          ;output the line coordinate
;
    mov  dl,bl          ;ready the column number
    mov  ah,6h          ;direct console output of DL
    int  msdos          ;send the column coordinate
;
; the cursor is now at the location selected in BX

```

2.4.3 Microsoft Pascal Compiler -- Direct Cursor Positioning

```
program position (input,output);
{This method uses offsets from line 0, column 0.}

const
  clear_screen = chr(27) * chr(69);

var
  result : array[1..4] of char;
  i, line, column : integer
  row, col : char;

begin
  result[1] := chr(27);           {RESULT = ESC}
  result[2] := chr(89);           {RESULT = "Y"}
  write (clear_screen);
  write (' Enter line (0-23) and column (0-79), as LINE COLUMN: ');
  readln (line, column);
  writeln (clear_screen);
  row := chr(32 + line);
  col := chr(32 + column);
  result[3] := row;              {RESULT = ROW}
  result[4] := col;              {RESULT = COL}
  for i := 1 to 4 do
    write (result[i]);           {PRINT CURSOR TO SCREEN}
    for i := 1 to 32000 do       {PAUSE}
end.
```

2.5 Transmit Page -- Examples of Use

The transmit page function is accessed by sending the ESC # sequence to the screen (see section 2.3.5). The result of this sequence is that all characters on the screen, as well as the cursor positioning sequences required to re-create the screen, are sent to the keyboard buffer. Reading the keyboard via a normal keyboard input request will return the entire screen of data to the program. The screen buffer within the program should be at least 1920 decimal bytes long to accomodate the entire screen - the program will need to perform 1920 single character inputs to empty the keyboard buffer. Note that the character input requests must be done rapidly to prevent the keyboard buffer overflowing and causing loss of data - note, too, that on a keyboard buffer overflow, the bell sounds.

The following sample programs demonstrate the use for this function request:

2.5.1 Microsoft MS-BASIC -- Transmit Page

```
10 DIM A$(1920)
20 PRINT CHR$(27)+"#";
30 FOR I = 1 TO 1920
40 A$(I)=INKEY$
50 NEXT I
60 PRINT CHR$(27)+"E";
70 FOR I = 1 TO 1920
80 PRINT A$(I);
90 NEXT I
```

2.5.2 Microsoft MACRO-86 Assembler -- Transmit Page

```

coniof      equ      6h          ;direct console i/o function
conin       equ      0ffh        ;console input request
printf      equ      9h          ;screen o/p up to $
msdos       equ      21h        ;interrupt operating system
buffer_length equ      1920      ;entire screen count

read_screen  db      1bh,'#$'    ;read entire screen
clear_screen db      1bh,'E$'    ;clear screen/home cursor
buffer       db      buffer_length dup (?) ;main buffer region

        mov      ax,DS          ;get buffer data segment
        mov      ES,ax          ;ready for store
        mov      di,offset buffer ;get storage buffer
        mov      si,di          ;init for later use
        mov      dx,offset read_screen ;read entire screen string
        mov      ah,printf      ;o/p it up to $
        int      msdos          ;call the OS
;

; now read entire screen in to BUFFER
;
        mov      ah,coniof      ;read from keyboard buffer
        mov      dl,conin        ;ready to read
        mov      cx,buffer_length ;count of chars to read
;
in_loop:
        int      msdos          ;get a char in AL
        stosb                ;save the char in BUFFER
        loop     in_loop         ; and loop til buffer full
;
        mov      ah,printf      ;ready to clear the screen
        mov      dx,offset clear_screen ;get the string
        int      msdos          ; and o/p it up to $
;
; now replace the screen data
;
        mov      cx,buffer_length ;get the count
        mov      ah,coniof      ;get the o/p char function
;
out_loop:
        lodsb                ;get a char
        mov      dl,al          ; ready to go
        int      msdos          ;o/p it
        loop     out_loop        ;loop til buffer empty
        ret
;
```

2.5.3 Microsoft Pascal Compiler -- Transmit Page

```
PROGRAM Scrnbuf;

CONST
  clear_screen  = CHR(27)*CHR(69)*CHR(36);
  transmit_page = CHR(27)*CHR(35)*CHR(36);
  err_msg        = 'ERROR$';
  direct_conio   = #6;
  conin          = #0FF;
  print_string   = #9;

VAR
  screen_dump : ARRAY [1..1920] OF CHAR;
  ch : CHAR;
  i : INTEGER;
  param : WORD;
  status : BYTE;

FUNCTION DOSXQQ( command, parameter : WORD ) : BYTE; EXTERNAL;

BEGIN
  EVAL(DOSXQQ(print_string,WRD(ADR(transmit_page)) ) );
  param:= BYWORD( 0, conin );
  status:= DOSXQQ( direct_conio, param );
  IF status <> 0 THEN
    BEGIN
      i:= 1;
      WHILE status <> 0 DO
        BEGIN
          ch:= CHR(status);
          screen_dump[i]:= ch;
          i:= i + 1;
          status:= DOSXQQ( direct_conio, param );
        END;
      i:= i - 1;
      EVAL(DOSXQQ(print_string,WRD(ADR(clear_screen)) ) );
      FOR VAR J:= 1 TO i DO
        EVAL(DOSXQQ( direct_conio, WRD(screen_dump[J]) ) );
    END
  ELSE
    EVAL(DOSXQQ(print_string,WRD(ADR(err_msg)) ) );
END.
```

CHAPTER 3

Victor 9000 Input/Output Port Specification

3.1 Device Connection

There are 5 ports available on the Victor 9000 - they are as follows:

- 2 x Serial (RS232C) - Ports A and B
- 1 x Parallel (Centronics)
- 2 x Parallel (control - located on CPU board)

The ports are located on the rear of the Victor 9000 as shown in the following diagram:

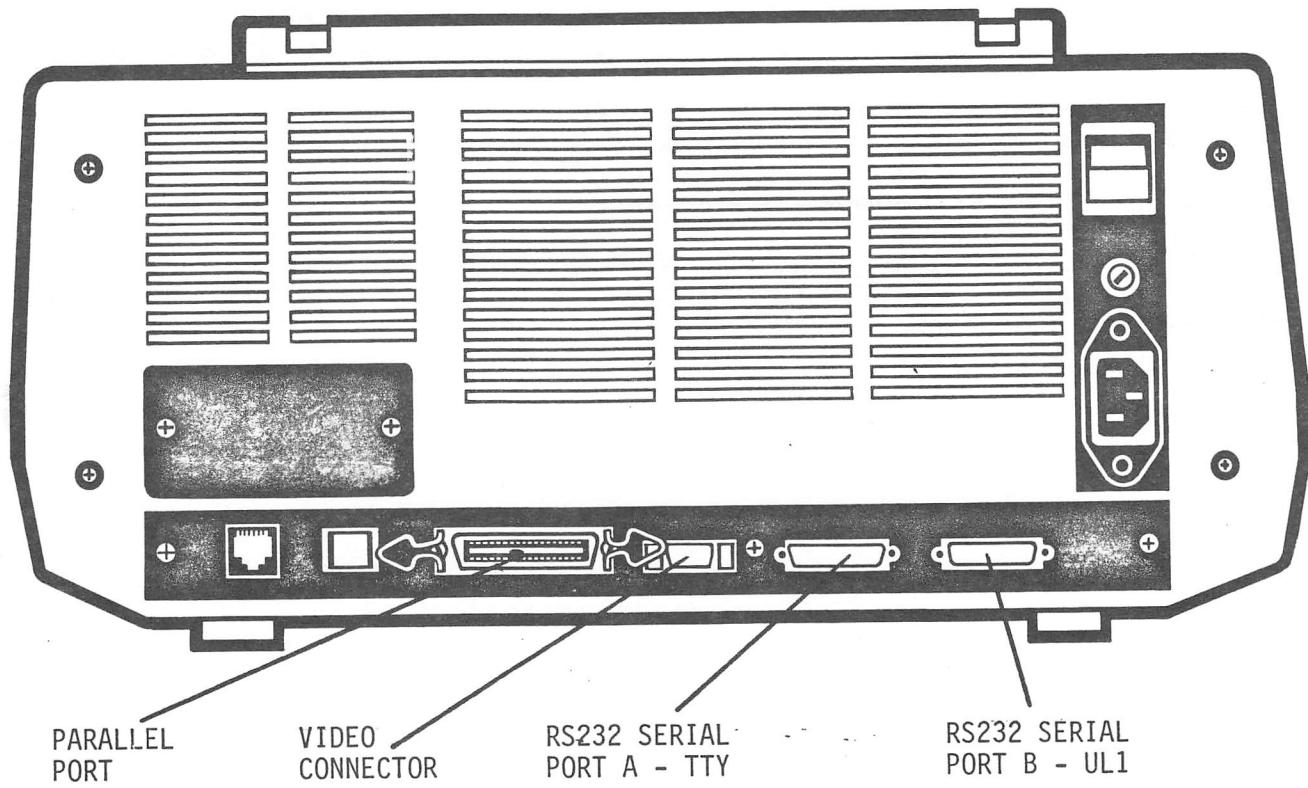


Figure 1
Victor 9000 Parallel and Serial Ports

3.2 Parallel Printer Connection

To connect a parallel printer to the Victor 9000, a suitable cable is required - if the printer is supplied by Victor Technologies, then it will be a matter of plugging the cable into both machines; cables should be attached as follows:

- 1) Disconnect power from both the computer and printer.
- 2) Disconnect the Victor video connector (see 3.1)
- 3) Attach interface cable to Victor and printer
- 4) Re-attach the video connector
- 5) Set the printer dip-switches as required

3.3 Parallel Cable Requirements

If a suitable parallel cable is not available, you will need to make one - use the guidelines that follow to create your own cable:

You will need a male centronics-compatible Amphenol 57-30360 type connector for the Victor 9000 end of the cable; use the type of connector suggested by the printer manufacturer for the printer end, in general, another male centronics-compatible Amphenol 57-30360 type connector will be required. You will also require a length of 12-core cable (10 feet maximum length).

Refer to the port layout in your printer handbook - compare this with the Victor 9000 parallel port layout (see C.1). If the pin numbers and signal requirements are the same, then construct the cable as follows:

1	-----	1
2	-----	2
3	-----	3
4	-----	4
5	-----	5
6	-----	6
7	-----	7
8	-----	8
9	-----	9
10	-----	10
11	-----	11
16	-----	16

It does not matter which end of the cable is connected to the printer or the computer.

Supplemental Technical Reference Material

If your printer has the same signals as the Victor 9000, but on differing pins, then use the following guidelines:

- 1) Label one connector "Computer" and the other "Printer".
- 2) Connect pin 1 at the computer connector to the Data strobe pin at the printer connector.
- 3) Connect pins 2 thru 9 at the computer connector to the Data1 (may be labelled Data0) thru Data8 (may be labelled Data7) at the printer connector.
- 4) Connect pin 10 at the computer connector to the ACK pin at the printer connector.
- 5) Connect pin 11 at the computer connector to the BUSY pin at the printer connector.
- 6) Connect pin 16 at the computer connector to the GROUND (may be labelled GND) pin at the printer connector.

The printer cable is now complete - it must always be attached to the devices as marked on the connectors - if it is not, then the printer will not work.

3.4 Serial Printer Connection

To connect a serial printer to the Victor 9000, a suitable cable is required - if the printer is supplied by Victor Technologies, then it will be a matter of plugging the cable into both machines; cables should be attached as follows:

- 1) Attach the cable between the Victor 9000 serial port B (see 3.1) and the printer connector.
- 2) Set the printer switches for 7-data bits, 1 stop bit, 1200 baud and no parity. Set DTR protocol (refer to printer manual).

You may set the baud rate at a rate different from that mentioned in (2) - but you will then be required to set the baud rate using the baud rate selection utility, PORTSET or PORTCONF (see 3.6), or alternatively you will need to build a new operating system.

3.5 Serial Cable Requirements

If a suitable serial cable is not available, you will need to make one - use the guidelines that follow to create your own cable:

You will require 1 x D25 male, 1 x D25 female connectors, and a length of 6-12 core cable, with a maximum length of forty feet. Refer to the port layout in your printer manual, if pin 3 is received data (labelled RXD or RD), and pin 20 is data terminal ready (labelled DTR), then construct your cable as follows:

Computer	Printer
1 -----	1
2 -----	3
3 -----	2
7 -----	7
5 -----	20

This cable, often called a Modem Eliminator Cable, must be attached as shown - mark the Computer/Printer connectors as a reference.

If pin 3 is receive data (RXD or RD) and pin 20 is not data terminal ready (DTR) then construct your cable as follows:

Computer	Printer
1 -----	1
3 -----	2
2 -----	3
7 -----	7
5 -----	4

This cable must be attached as shown - mark the Computer/Printer connectors as a reference.

3.6 Operating System Port Utilities

Victor Technologies supplies a selection of programs under both CP/M-86 and MS-DOS to allow the temporary selection of both baud rate and list device port. If you attach a printer to your system you may be required to perform some of the following steps in order to utilize the printer. Before you use any of the utilities discussed you need to be aware of the port the printer is attached to; Port A, B or Parallel. You will also need to know, except in the case of a parallel printer, what the baud rate, stop-bits and parity your printer is set up at. Note that many printers will start to lose data at baud rates above 4800, you must, therefore, select a baud rate that your printer can handle.

3.6.1 SETIO - MS-DOS List Device Selection Utility

To select the correct port for the list device you have attached, the SETIO program has been provided. This program is used as follows:

```
SETIO LST = TTY - printer is attached to port A
SETIO LST = ULL - printer is attached to port B
SETIO LST = LPT - printer is attached to parallel port
```

It is recommended that your printer be attached to either port B or the parallel port.

Once SETIO has executed, it displays a map of the ports, with the ones you selected highlighted on the screen - if this is not correct, repeat the process.

3.6.2 STAT - CP/M-86 List Device Selection Utility

To select the correct port for the list device you have attached, the STAT program has been provided. This program is used as follows:

```
STAT LST:=TTY: - printer is attached to port A
STAT LST:=ULL: - printer is attached to port B
STAT LST:=LPT: - printer is attached to parallel port
```

It is recommended that your printer be attached to either port B or the parallel port.

3.6.3 PORTSET - MS-DOS Baud Rate Selection Utility

To select the correct baud rate for ports A or B (but this is not applicable to the parallel port), the PORTSET program is provided. This program is menu driven, and is used as follows:

To the prompt type PORTSET, the screen will display a choice of three ports:

- 1) Port A (RS232C)
- 2) Centronics/Parallel Port
- 3) Port B (RS232C)

Type either 1,2 or 3. If you type 1 or 3, the next menu screen is displayed - this screen has baud-rate choices labelled A through N - select one of the baud-rates.

3.6.4 PORTCONF - CP/M-86 Baud Rate Selection Utility

This program is used in exactly the same manner as PORTSET (see 3.6.3).

3.7 Serial Input/Ouput Ports

The two serial input/output ports are memory mapped ports located in the memory segment E000hex; and they are mapped as follows:

E000:40	-	port A data (input/output)
E000:41	-	port B data (input/output)
E000:42	-	port A control (read/write)
E000:43	-	port B control (read/write)

The following information is available in each port's control register:

bit 0	-	rx character available
bit 1	-	not used
bit 2	-	tx buffer empty
bit 3	-	DCD
bit 4	-	not used
bit 5	-	CTS
bit 6	-	not used
bit 7	-	not used

See Appendix C.2 for information on each port's pinouts.

Note that writing a 10hex to the relevant control register allows the resensing of the modem leads (i.e. DCD and CTS) with their current values being updated in the port's control register.

Since the Victor 9000 configures the NEC 7201 chip to operate in auto-enable mode, DCD (pin 8 on the port connector) must be ON, and CTS (pin 5 on the port connector) must be ON to enable the 7201's receiver and transmitter respectively. RTS and DTR are always ON as a convenient source for an RS-232C control ON (+11 volts).

3.8 Baud Rate and Data Input/Output - Sample Programs

The means of establishing the baud rates, receiving and transmitting data are discussed in the following programs. The serial port's control register are discussed in 3.7 - the means of accessing them is better described with the programming examples that follow.

The following programs provide information on how to set up the baud rates on the serial ports (A and B) - they also demonstrate how to send and receive data from these ports.

3.8.1 Microsoft MS-BASIC -- Baud Rate and Data Input/Output

The following program may be used in place of PORTSET or PORTCONF if you omit the lines 500 through 740 inclusive.

```

10 DIM RATE(14)
20 REM Select the data port
30 PRINT CHR$(27)+"E"; : REM Clear the screen
40 PRINT : PRINT : PRINT : PRINT
50 PRINT "The serial ports are:" : PRINT
60 PRINT , " A - Serial Port TTY - left hand on back"
70 PRINT , " B - Serial Port ULL - right hand on back"
80 PRINT : PRINT
90 PRINT , "Select the port you want to use, A or B ";
100 PORT$ = INPUT$(1)
110 PRINT PORT$
120 IF PORT$ = "a" THEN STATIO=2 : DATIO=0 : GOTO 210
130 IF PORT$ = "A" THEN STATIO=2 : DATIO=0 : GOTO 210
140 IF PORT$ = "b" THEN STATIO=3 : DATIO=1 : GOTO 210
150 IF PORT$ = "B" THEN STATIO=3 : DATIO=1 : GOTO 210
160 GOTO 30
200 REM Set the baud rate
210 PRINT CHR$(27)+"E"; : REM Clear the screen
220 PRINT : PRINT : PRINT : PRINT
230 PRINT "The available baud rates are as follows:" : PRINT
240 PRINT , " 1 = 300 baud"
250 PRINT , " 2 = 600 baud"
260 PRINT , " 3 = 1200 baud"
270 PRINT , " 4 = 2400 baud"
280 PRINT , " 5 = 4800 baud"
290 PRINT , " 6 = 9600 baud"
300 PRINT , " 7 = 19200 baud"
310 PRINT : PRINT : PRINT
320 PRINT "Select one of the above baud rates: ";
330 RATE$ = INPUT$(1)
340 IF RATE$ > "7" THEN 210
350 IF RATE$ < "1" THEN 210
360 PRINT RATE$
400 REM Now set the baud rate in the port selected
410 DEF SEG = &HE002
420 IF DATIO = 0 THEN POKE 3,54 : IF DATIO = 1 THEN POKE 3,118
430 FOR I = 1 TO 14
440 READ RATE(I) : REM Set the baud rate matrix
450 NEXT I
460 NODE = (VAL(RATE$)-1)*2+1
470 POKE DATIO,RATE(NODE)
480 POKE DATIO,RATE(NODE+1)

```

-- Listing Continued on Next Page --

Supplemental Technical Reference Material

```
500 REM Now data may be entered and sent down line
510 PRINT CHR$(27)+"E"; : REM Clear the screen
520 PRINT : PRINT , "Baud rate established"
530 PRINT : PRINT : PRINT
540 DEF SEG = &HE004
550 PRINT , "Enter data to be sent down line with return to end"
560 PRINT , "or just press return to receive data -"
570 PRINT
580 TEXT$=INKEY$
590 IF TEXT$="" THEN 630
600 IF TEXT$=CHR$(13) THEN PRINT TEXT$ : TEXT$=CHR$(126) :GOTO 620
610 PRINT TEXT$;
620 GOSUB 650
630 GOSUB 690
640 GOTO 580
650 STATUS=PEEK (STATIO) : STATUS=STATUS AND 4
660 IF STATUS = 0 THEN 650 :REM Waiting to send char
670 POKE DATIO, ASC(TEXT$)
680 RETURN
690 STATUS = PEEK(STATIO) : STATUS = STATUS AND 1
700 IF STATUS = 0 THEN RETURN : REM No char available
710 DATUM = PEEK (DATIO) : DATUM = DATUM AND 127
720 IF DATUM = 126 THEN PRINT CHR$(13) : RETURN
730 PRINT CHR$(DATUM); :REM Show char from line
740 RETURN
1000 DATA 04,1,&H82,0,&H41,0,&H20,0,&H10,0,8,0,4,0
```

3.8.2 MACRO-86 Assembler -- Baud Rate and Data Input/Output

The following assembler modules may be included in a program and called with the stated parameters. The character input and output modules will need re-coding if your program requires status return rather than looping for good status.

```

rates  db      04h,1h,82h,0h      ;baud rate conversion table
      db      41h,0h,20h,0h
      db      10h,0h,8h,0h
      db      4h,0h

;*****  

;  

; Routine:      BAUD_SET  

;  

; Function:     To set Port A or B baud rate  

;  

; Entries:      AL = 0=PortA, 1=PortB  

;                DX = 0=300 baud, 1=600 baud, 2=1200 baud  

;                3=2400 baud, 4=4800 baud, 5=9600 baud  

;                6=19200 baud  

;  

; Returns:      None  

;  

; Corruptions: ES, AX, BX, CX, DX
;*****  

;  

baud_set:  

      mov      cx,0e002h      ;get the segment  

      mov      ES,cx      ;init the segment register  

      mov      bx,3      ;point to counter control  

      or       al,al      ;see if Port A or B to be set  

      jnz      set_B      ;AL > 0, so set Port B counter  

;  

      mov      byte ptr ES:[bx],36h      ;set it for port A  

      jmp      short set_rate      ; and input the Baud rate  

;  

set_B:  

      mov      byte ptr ES:[bx],76h      ;set port B counter  

;  

set_rate:  

      mov      bx,offset rates      ;get the baud rate table  

      shl      dx,1      ;DX = DX * 2 for words  

      add      bx,dx      ;point to baud rate entry  

      mov      dx,[bx]      ;get the baud rate  

      xor      bh,bh      ;BH=0  

      mov      bl,al      ;get the required port  

      mov      byte ptr ES:[bx],dl      ;send first byte  

      mov      byte ptr ES:[bx],dh      ; and last byte of rate  

      ret      ;baud rate established

```

3.8.2 Baud Rate and Data Input/Output -- continued

```
;*****  
;  
; Routine:      SEND_CHAR  
;  
; Function:     To output a character to a serial port  
;  
; Entries:      AL = 0=PortA, 1=PortB  
;                AH = Character to send  
;  
; Returns:      None  
;  
; Corruptions:  ES, AX, BX  
;  
;*****  
  
send_char:  
    mov     bx,0e004h          ;get the port segment  
    mov     ES,bx              ;set the segment  
    xor     bh,bh              ;BH=0  
    mov     bl,al              ;get the required port  
    add     bl,2               ;required port status  
;  
in_status_loop:  
    mov     al,ES:[bx]          ;get the status  
    and     al,4h              ;mask for TX empty  
    jz      in_status_loop    ;not ready - loop  
;  
    sub     bl,2               ;point to data  
    mov     ES:[bx],ah          ;character gone  
    ret
```

3.8.2 Baud Rate and Data Input/Output -- continued

```
;*****  
;  
; Routine:      GET_CHAR  
;  
; Function:     To input a character from a serial port  
;  
; Entries:      AL = 0=PortA, 1=PortB  
;  
; Returns:      AL = character  
;  
; Corruptions: ES, AX, BX  
;  
;*****  
  
get_char:  
    mov     bx,0e004h          ;get the port segment  
    mov     ES,bx              ;set the segment  
    xor     bh,bh              ;BH=0  
    mov     bl,al              ;get the required port  
    add     bl,2               ;required port status  
;  
    out_status_loop:  
        mov     al,ES:[bx]      ;get the status  
        and     al,1h            ;mask for RX character avail  
        jz      out_status_loop ;not ready - loop  
;  
        sub     bl,2             ;point to data  
        mov     al,ES:[bx]      ;character received  
        ret
```

APPENDIX A

A.1

ASCII Codes Used in the Victor 9000 Computer

The American Standard Codes for Information Interchange (ASCII) has been defined to allow data communication between computers, their peripherals, and other computers. The other major code standard is the Extended Binary Coded-Decimal Interchange Code (EBCDIC) used on some mainframe computers. The Victor 9000 computer is designed to function in ASCII, but communication software is available that allows the Victor 9000 to receive EBCDIC data and have it translated into ASCII, and vice versa.

The following table contains the 7-ASCII codes and their meanings. It is called 7-ASCII as only 7-bits of the potential 8-bits are used to carry data; the "spare" bit is utilized in the Victor 9000 computer to support characters not otherwise available in the 7-ASCII set.

An Eight Bit Byte is pictured as follows:

[7][6][5][4][3][2][1][0]

the bits are numbered 0 through 7 (which adds up to eight bits), and it is the 8th bit (bit 7 in computer jargon) which is not used in 7-ASCII.

A-2

ASCII / HEXADECIMAL / DECIMAL Character Set

ASCII	Hex	Dec									
NUL	00	00	space	20	32	@	40	64	'	60	96
SOH	01	01	!	21	33	A	41	65	a	61	97
STX	02	02	"	22	34	B	42	66	b	62	98
ETX	03	03	#	23	35	C	43	67	c	63	99
EOT	04	04	\$	24	36	D	44	68	d	64	100
ENQ	05	05	%	25	37	E	45	69	e	65	101
ACK	06	06	&	26	38	F	46	70	f	66	102
BEL	07	07	-	27	39	G	47	71	g	67	103
BS	08	08	(28	40	H	48	72	h	68	104
HT	09	09)	29	41	I	49	73	i	69	105
LF	0A	10	*	2A	42	J	4A	74	j	6A	106
VT	0B	11	+	2B	43	K	4B	75	k	6B	107
FF	0C	12	-	2C	44	L	4C	76	l	6C	108
CR	0D	13	'	2D	45	M	4D	77	m	6D	109
SO	0E	14	.	2E	46	N	4E	78	n	6E	110
SI	0F	15	/	2F	47	O	4F	79	o	6F	111
DLE	10	16	0	30	48	P	50	80	p	70	112
DC1	11	17	1	31	49	Q	51	81	q	71	113
DC2	12	18	2	32	50	R	52	82	r	72	114
DC3	13	19	3	33	51	S	53	83	s	73	115
DC4	14	20	4	34	52	T	54	84	t	74	116
NAK	15	21	5	35	53	U	55	85	u	75	117
SYN	16	22	6	36	54	V	56	86	v	76	118
ETB	17	23	7	37	55	W	57	87	w	77	119
CAN	18	24	8	38	56	X	58	88	x	78	120
EM	19	25	9	39	57	Y	59	89	y	79	121
SUB	1A	26	7	3A	58	Z	5A	90	z	7A	122
ESC	1B	27	3B	59	1	5B	91	1	{	7B	123
FS	1C	28	3C	60	5C	92	1	7C	124	7C	124
GS	1D	29	3D	61	5D	93	1	7D	125	7D	125
RS	1E	30	3E	62	5E	94	1	7E	126	7E	126
US	1F	31	3F	63	5F	95	1	7F	127	7F	127

APPENDIX B

B.1

Victor 9000 Keyboard Layout

Legend:

Shaded region indicates unused key switch

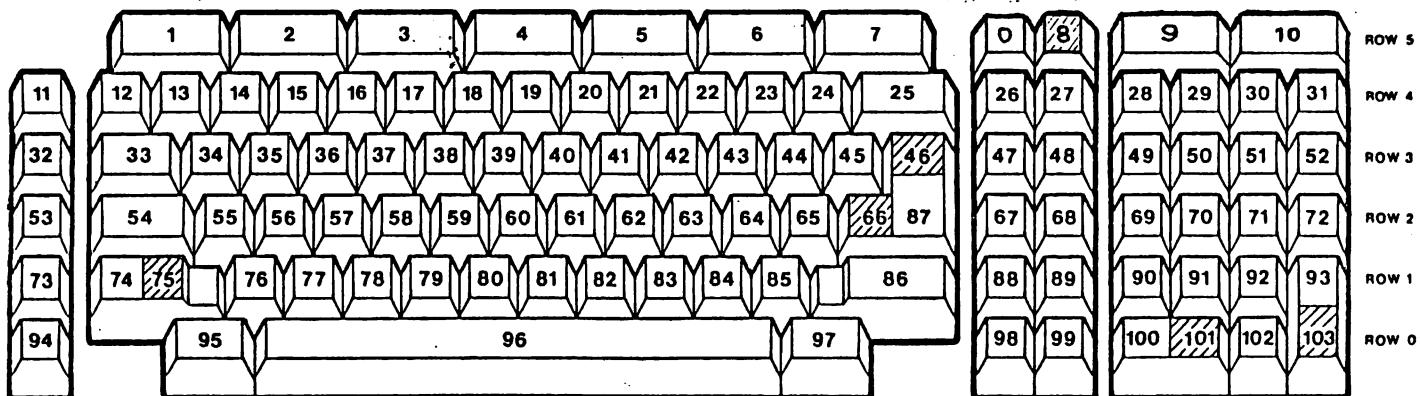


Figure 2
Victor 9000 Keyboard Configuration
with Key Switch Positions and Logical Key Numbers

Supplemental Technical Reference Material

APPENDIX C

C.1

Victor 9000 Parallel (Centronics) Port

Pin Number	Signal
1	----- Data Strobe
2	----- Data 1
3	----- Data 2
4	----- Data 3
5	----- Data 4
6	----- Data 5
7	----- Data 6
8	----- Data 7
9	----- Data 8
10	----- ACK
11	----- Busy
17	----- Pshield
12,18,30,31	----- Not connected
Remaining	----- GND

C.2

Victor 9000 Serial (RS-232C) Port

Pin Number	Signal
1	----- FG Frame Ground
2	----- TD Transmitted Data
3	----- RD Received Data
4	----- RTS Request to Send
5	----- CTS Clear to Send
6	----- DSR Data Set Ready
7	----- SG Signal Ground
8	----- DCD Data Carrier Detect
15	----- TC Transmitter Clock
17	----- RC Receiver Clock
20	----- DTR Data Terminal Ready
22	----- RI Ring Indicator

C.3

Victor 9000 IEEE-488 Port

The Victor 9000 IEEE-488 cable attaches to the parallel port - the pin number refers to the actual computer port connector; the IEEE-488 pin number refers to the standard IEEE-488 pin-out as they must attach to the parallel port.

The IEEE pin numbers referred to with (**z) are wires that are to be bound together as twisted pairs.

Pin Number IEEE Signal IEEE Pin Number

1	-----	DAV	-----	6	(**a)
19	-----	GND	-----	18	(**a)
2	-----	DIO1	-----	1	
3	-----	DIO2	-----	2	
4	-----	DIO3	-----	3	
5	-----	DIO4	-----	4	
6	-----	DIO5	-----	13	
7	-----	DIO6	-----	14	
8	-----	DIO7	-----	15	
9	-----	DIO8	-----	16	
10	-----	NRFD	-----	7	(**b)
28	-----	GND	-----	19	(**b)
11	-----	SRQ	-----	10	(**c)
29	-----	GND	-----	22	(**c)
13	-----	NDAC	-----	8	(**d)
33	-----	GND	-----	20	(**d)
15	-----	EOI	-----	5	
17	-----	shield	-----	12	
34	-----	REN	-----	17	
35	-----	ATN	-----	11	(**e)
16	-----	GND	-----	23	(**e)
36	-----	IFC	-----	9	(**f)
27	-----	GND	-----	21	(**f)
20	-----	GND	-----	24	

C.4

Victor 9000 Control Port

Pin Number	Signal
1	-12V
2	-12V
3	Not connected
4	Not connected
5	+12V
6	+12V
7	+5V
8	+5V
9	Not connected
10	Light Pen
11	GND
12	CA1
13	GND
14	CA2
15	GND
16	PA0
17	GND
18	PA1
19	GND
20	PA2
21	GND
22	PA3
23	GND
24	PA4
25	GND
26	PA5
27	GND
28	PA6
29	GND
30	PA7
31	GND
32	PB0
33	GND
34	PB1
35	GND
36	PB2
37	GND
38	PB3
39	GND
40	PB4
41	GND
42	PB5
43	GND
44	PB6
45	GND
46	PB7 / CODEC Clock Output
47	GND
48	CB1
49	GND
50	CB2